Pencil and Paper homework Number 8a

This homework concerns applied problems. Please note the answers are betaware and may contain errors.

1) Rancher Aloysius Optimus wishes to put a field along the side of a river but he wants to separate the steers from the cows. He want to give them equal areas. So there are three fences perpendicular to the river and one fence parallel to it. If there is 1200 meters of fencing available, what dimensions give the maximum area? Ans: little fences = 200

2) A woman wishes to build a garage with a flat roof from 88 meter^2 of wood. Zoning restrictions insist that the length be 1.5 times the width. What are the dimensions with the greatest volume? Ans: Vol = 77.xx01

3) The same woman wishes to build a chicken coop. The Chicken Lovers Association has got a law passed that the coop must contain 60 meter^3 and zoning restrictions for coops insist it must be twice as long as it is wide. If the sides cost \$4 per meter^2 and the roof costs \$6 per meter^2 find the dimensions that give the minimum cost. Ans: height=3.xx723

4) Optimizer Man wishes to take a rectangular sheet of cardboard 6 meter by 10 meter and cut squares out of the corners and fold it up into an open box. What size squares should he cut out to give the maximum volume? Ans: Vol = 32.xx530

5) Management tells Optimizer Man that he can use only 100 cm^2 for the cans of soup. What dimensions give the maximum volume? Ans: vol= 7x.x765

6) Count Friedrich Magnus of Solms-Wildenfels, heir to the castle of the principality of Schwarzenburg-Sonderhausen, wishes to put a new window in the castle. The Denkmalschutzgesetz mandates that the new window must match the old windows which are rectangles with half circles on top of the rectangles (these are called Norman windows). Further regulations amount to this; that the perimeter of the window (three sides of the rectangle plus around the half circle) must be 20 meters or less. Find the dimensions that let in the most light (= greatest area). Area= 20.005 bottom = 5.6010 (funny looking window)

7a) Find the dimensions (and Area) of the largest (in area) rectangle that can be inscribed in a circle of radius a. This means that all four corners of the rectangle must lie on the circle.

7b) Same as 7a, but we put the rectangle in a semicircle and only the top two corners are on the circle; the bottom two are on the diameter. Are these two problems related? Area= a^2

8) A trapezoid is wider at the top than at the bottom. The bottom and the two sides of the trapezoid are all 2 meters long. How long should the top be so that the trapezoid has maximum area? (This problem is hard, but can be solved if you use as variable the angle in the upper left corner. You also need to know that the area of a trapezoid is the average of the top and bottom times the height.) Ans: height = 1.73205 angle = $\frac{\pi}{3}$